

## Variation in *Hebe* (SCROPHULARIACEAE) at Huia and Blockhouse Bay, New Zealand

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### Abstract.

Measurements of specimens from two populations of *Hebe* have been plotted in pictorialized scatter diagrams. The diagrams support the existing taxonomic arrangement. The value of such diagrams for the recognition of taxa, for the illumination of relationships, and for the illustration of variation is stressed.

Last December I wrote a short paper (Cooper, 1954) to draw the attention of New Zealand botanists to the value of the techniques devised by Dr. Edgar Anderson (Anderson, 1949) for the study of hybridization in wild populations. In this paper I have used the techniques to illustrate the complex pattern of variation in vegetative and floral characters of *Hebe* from two localities near Auckland.

Huia is a bay on the Manukau Harbour and is 23 miles west of Auckland City. The bay is at the southern end of the Waitakere Ranges and the steep hills about it are clad in coastal scrub and second growth forest. Specimens of *Hebe* were gathered on the east and west sides of the bay, along the road to Whatipu between Little Huia and Mt. Donald McLean, and along a track from this hill to the Karamatura Stream. I am indebted to Mrs. K. Wood for most of the collections from Huia.

Duck Creek is a small stream entering the Manukau Harbour in Blockhouse Bay, and the stream valley contains remnants of coastal forest and scrub. The Blockhouse Bay specimens were gathered on the margins of the forest and in the scrub. Samples of both populations were collected at random, but specimens were chosen deliberately from approximately the same position on each plant.

The following characters were measured for the first four diagrams:

1. Length of one of the pair of leaves immediately below the inflorescence.
2. Width of the leaf.
3. Length of the second internode below the inflorescence.
4. Length of the pedicel of a fully opened flower in the raceme.
5. Length of the fully opened flower.

Internode length and leaf width were chosen as the vertical and horizontal axis respectively and the measurements of these characters were plotted as scatter diagrams. Leaf, pedicel and flower lengths are represented in the diagrams as rays from the dots. The measurements of 35 plants from Huia and of the same number of plants from

Blockhouse Bay were grouped in three equal categories to determine the values to be given for no rays, short rays and long rays.

The first diagram shows the pattern of variation in a collection from Huia. In the lower left-hand corner of the diagram plants with small internodes and narrow leaves have short leaves, pedicels and flowers. In the upper right-hand corner of the diagram a plant with long internodes and broad leaves has long leaves, pedicels and flowers. Specimens near these two extremes show to a lesser degree the characters of the extremes.

The second diagram shows the pattern of variation in one of the collections made at Duck Creek, Blockhouse Bay. Again the characters are correlated, but most of the specimens are larger than those from Huia.

In the third diagram the measurements of herbarium specimens collected in the district between Auckland City and the West Coast are plotted. In the upper right-hand corner of the diagram the four symbols with long rays represent herbarium collections of *Hebe macrocarpa* (Vahl) Ckn. et Allan, identified as this species by Cheeseman. The number alongside each symbol refers to the list of species and hybrids given later. In the lower left-hand corner there are four dots without rays representing the type collections of *H. obtusata* (Cheesem.) Ckn. et Allan, and immediately above them are two dots without rays representing type collections of *Veronica x bishopiana* Petrie, a suspected hybrid between *H. obtusata* and *H. salicifolia*. The intermediates represented by dots with a single short or long ray are *H. salicifolia* (Forst. f.) Pennell var. *stricta* (Hook. f.) Ckn. et Allan and var. *longiracemosa* (Ckn.) Ckn. et Allan. The intermediate represented by a symbol with two long rays in the centre of the diagram is a specimen of *H. x macrosala* Ckn. et Allan, a putative hybrid between *H. macrocarpa* and *H. salicifolia*. Only a few specimens of each species and hybrid are shown on the diagram as the herbarium collections of *Hebe* from the Auckland district are small, and frequently the material in a species folder is so uniform that there can be little doubt that it all came from a single plant. Other specimens have been added to the herbarium because they are unusual in one or more characters, and sometimes these abnormal specimens outnumber the typical specimens.

An analysis of the descriptions in Cheeseman's Manual of the New Zealand Flora, ed. 2, 1925, and the published notes of Cockayne and Allan, indicates that the critical characters used for the separation of the species are plant habit and size, leaf shape and size, flower colour and size, and capsule shape and size. On the five vegetative and floral characters used in these diagrams the Huia collection comprises:

*H. obtusata*.—Dots without rays in the lower left-hand corner.

Petrie's *x bishopiana*.—Dots without rays slightly above and to the left of *H. obtusata*.

*H. salicifolia* var. *stricta*.—Intermediate symbols with short rays.

*H. x macrosala*.—Dots with some long rays towards the upper right-hand corner.

*H. macrocarpa*.—Dot with three long rays in the upper right-hand corner.

The Blockhouse Bay collection comprises:

*H. salicifolia* var. *stricta*.—Dots with short rays.

*H. x macrosala*.—Dots with some long rays.

*H. macrocarpa*.—Dots with three long rays.

In using these names I am following Cockayne and Allan (1926), who transferred the wild species of *Veronica* to the genus *Hebe* and recognized the following species and hybrid swarms as native to the Waitakere Ranges and suburbs of Auckland:

1. *H. obtusata* (Cheesem.) Ckn. et Allan. This species was described by Cheeseman from plants collected on the sea cliffs at Karekare and Muriwai.

2. *H. salicifolia* (Forst. f.) Pennell var. *stricta* (Hook. f.) Ckn. et Allan. The type material cited by J. D. Hooker in *Flora Novae Zelandiae* 1: 191, 1853, was collected by Banks and Solander. This collection was not made in the Auckland district and may not be identical with Auckland plants.

3. *H. salicifolia* (Forst. f.) Pennell var. *longiracemosa* (Ckn.) Ckn. et Allan. Cockayne described this variety in *Trans. N.Z. Inst.* 49: 61, 1917, and gave the distribution of it as Egmont-Wanganui botanical district. Cockayne and Allan (1926) mentioned that the variety occurs without evidence of polymorphy throughout that district. Cheeseman in the *Manual*, ed. 2, 791, 1925, recorded the variety from the Volcanic Plateau, East Cape and South Auckland districts, and in his herbarium there is a specimen which he collected at the Waitakere Falls.

4. *H. macrocarpa* (Vahl) Ckn. et Allan. Vahl's paper and the type are not available, and Cockayne and Allan (1926) considered the species to be a linneon which required extended study in the field. *Hebe macrocarpa* (Vahl) Ckn. et Allan var. *latisejala* (Kirk) Ckn. et Allan has not been included in the scatter diagram of herbarium specimens as it has not been reported from the vicinity of Auckland City or the Waitakere Ranges.

5. *H. x macrosala* Ckn. et Allan. (*H. macrocarpa* x *salicifolia*).

6. *H. x affinis* (Cheesem.) Ckn. et Allan. The type locality of Cheeseman's var. *affinis* was "headlands in the Waitemata and Manukau Harbours." Cockayne and Allan (1926) considered the variety to be part of the hybrid swarm between *H. macrocarpa* and *H. salicifolia*, which they named *H. x macrosala*.

7. Petrie (1926) described *Veronica bishopiana* as a hybrid between *H. salicifolia* and *H. obtusata* from plants collected on rocky knobs between Huia Hill and Little Huia. Cockayne and Allan (1926) could not determine the status of the plant "since his [Petrie's] description might well apply to an "invariable" species, and there is only one specimen in his herbarium."

Dr. Edgar Anderson in a paper on recombination in species crosses (Anderson, 1939) pointed out that many generations of deliberate breeding would be required to break all the linkages between multiple factor characters and that from this there followed two obvious criteria of hybridization under natural conditions:

1. The intermediacy of separate characters will be correlated. Hybrids intermediate in one character will tend to be intermediate in

others. Hybrids which are most like either parent in any one character will tend to resemble that parent in all other characters.

2. Variation between individuals will lessen as parental character combinations are approached.

On the Huia diagram specimens matching the type collection of Petrie's *x bishopiana* are intermediate between specimens resembling Cheeseman's *H. obtusata* and others which are recognized as *H. salicifolia*. Again, in the Blockhouse Bay diagram specimens matching Cockayne and Allan's *H. x macrosala* are intermediate between specimens resembling the reputed parents *H. macrocarpa* and *H. salicifolia*. *Hebe macrocarpa* flowers mainly in August and *H. salicifolia* flowers in June and July, but the flowering times of the two species overlap and the difference in flowering times is not a barrier to hybridization.

It seems then that the scatter diagrams of internode, leaf and floral characters support the existing taxonomic arrangement to some extent, but the plants obviously need further study. It is remarkable in view of the number of species recognized previously that none of the herbarium material matches the specimens in the extreme left-hand corner of the Huia diagram. These may be depauperated specimens of *H. obtusata* and *H. salicifolia* var. *stricta*.

Another hypothesis to account for the variation is that the two extremes, represented by rayless dots on the Huia diagram and long rayed dots on the Blockhouse Bay diagram, are "species" while all the intermediate forms are part of a hybrid population between them. Genetic analysis of the populations would be necessary to provide some supporting evidence for this suggestion and that study is outside the scope of this paper, the purpose of which is to stress the potential value of mass collections and scatter diagrams in formal taxonomy. It is obvious, however, that the diagrams illustrate the range of variants in each population remarkably well and would be a useful guide to a geneticist in planning the analysis of the populations.

It may be doubted whether a collection of 35 plants is an adequate sample of a population. Two subsequent collections from the Blockhouse Bay area show, however, a similar pattern of variation to that of the first collection. It may also be doubted whether the variation in the Huia and Blockhouse Bay collections should be explained on genetical grounds. The genus *Hebe* is notoriously plastic and the variation may be the result of ecological factors. In making the collections, however, small areas were chosen which appeared to be uniform in soil and climatic conditions. On an exposed clay bank at Blockhouse Bay, eleven flowering plants were found which were obviously dwarfed, being 30 cms. or less in height. The measurements of five characters of these plants are plotted on diagram 4. The dots are all at the extreme lower left-hand corner of the diagram, as the plants have very short internodes and narrow leaves, but the pedicels and flowers of ten of the eleven specimens are represented by rays. Probably the flowers are less plastic than the stems and leaves and indicate that the plants are dwarfed members of the intermediate group.

As a check on the diagrams further collections were made from fruiting plants and the following characters of each specimen were measured:

1. Length of one of the pair of leaves immediately below the inflorescence, as before.

2. Width of same.
3. Length of the second internode, as before.
4. Width of a ripe capsule.
5. Length of same.

In diagrams numbered 5, 6, 7 and 8, the measurements of these additional collections from Huia, Blockhouse Bay, the Cheeseman Herbarium, and the clay bank near Duck Creek, have been plotted. The arrangement of the symbols in the diagrams of fruiting specimens is very similar to the pattern of variation illustrated in the first four diagrams of flowering plants.

**General:** From pictorialized scatter diagrams such as those of the Huia and Blockhouse Bay populations of *Hebe*, information can be obtained regarding:

1. The grouping of characters;
2. The relationships of taxa; and
3. The variation within taxa.

1. *Character groupings*: Robson (1928) remarked "ill defined as they may be and of varying dimensions, a certain tendency to character groupings of a certain stability is fairly recognizable [in biological material]." The designation of such groupings as "species" or "variety" presents difficulty, however. The system is arbitrary, but only in this respect—the character groupings themselves have reality. The discernment of morphological similarities and differences is intuitive through contemplation of the form of plant structures (cf. Agnes Arber, pp. 121-126, 1954), and Woodson (personal communication), has described the process as "the unconscious application of the frequency curve technique." In a pictorialized scatter diagram a number of frequency curves may be studied together and the diagram, which was devised originally for the study of hybrid populations, should prove to be of great value for the recognition of plant taxa.

2. *Relationships*: Robson (1928) wrote: ". . . if the systematist were to adopt some method of expressing character groupings and combinations as an adjunct to his traditional method, it would illustrate the structural relationships of allied forms in a very useful manner." In a study of the Australian and New Zealand species of *Pittosporum* (unpublished). I interpreted the distribution of life-forms, the various kinds of inflorescence, the various leaf types and capsule types as due to evolution by reduction, possibly under the influence of aridity, and used a scatter diagram of the average measurements of five characters for each species in support of my hypothesis.

3. *Variation within taxa*: Clausen (1951) emphasized that the local population is the basic unit in plant evolution and that there is considerable individual variation within each local population, even in populations of apomictic species that propagate as clones. He used photographs, diagrams, histograms, graphs and tables to illustrate this variation, and his illustrations convey a much clearer impression than the subspecific or varietal epithet. The scatter diagram should prove as valuable as the other illustrations mentioned to provide an accurate pictorial image of the variation in a local population or larger taxonomic category.

Table 1.

Mass collection of flowering specimens from Huia, mainly between reference points 088420 and 066397 on the N.Z. Lands and Survey Waitakere map of 1943 (1:63360 series).

No.	Internode length.	Leaf width.	Leaf length.	Pedicel length.	Flower length.
1	15	16	56	4	9
2	15	11	36	3	7
3	14	15	45	2	5
4	16	18	64	3	8
5	12	10	51	2	7
6	16	22	80	2	8
7	16	23	91	3	10
8	11	19	65	2	9
9	8	11	38	2	7
10	14	12	50	3	7
11	10	8	27	2	5
12	8	16	37	3	6
13	6	15	50	3	6
14	7	13	42	2	6
15	5	11	26	1.5	5
16	14	17	67	3	7
17	11	10	35	3	6
18	15	13	36	2	6
19	11	14	37	2	5
20	8	8	28	2	7
21	7	11	47	2	6
22	7	10	46	2	6
23	24	21	94	4	8
24	11	9	42	2	5
25	17	13	60	3	7
26	9	10	44	2	5
27	15	11	50	2	5
28	11	13	43	3	7.5
29	13	12	57	2	9
30	8	11	35	2.5	6
31	6	12	30	2	4
32	6	7	21	2	4
33	15	14	54	2	6
34	9	18	58	2	6
35	15	17	65	3	7

Table 2.

Mass collection from Duck Creek, Blockhouse Bay, between reference points 237517 and 232515 on the N.Z. Lands and Survey Titirangi map of 1944 (1:25,000 series).

No.	Internode length.	Leaf width.	Leaf length.	Pedicel length.	Flower length.
81	27	20	67	4	8
82	22	21	73	4	8
83	24	23	78	4	8
84	23	20	73	4	7
85	16	20	66	3	6
86	23	19	74	4	7
87	17	18	71	4	7
88	17	13	52	3	6
89	19	11	36	3	7
90	29	26	82	4	8

No.	Internode length.	Leaf width.	Leaf length.	Pedicel length.	Flower length.
91	20	20	84	4	6.5
92	18	19	54	4	6.5
93	25	25	101	4	8
94	14	16	59	3	7
95	15	15	52	3	7
96	19	17	70	3	8
97	21	21	64	4	9
98	24	19	91	5.5	9
99	15	21	75	4	8
100	13	15	63	3	7.5
101	19	18	70	3	7
102	17	13	45	3	7.5
103	17	19	61	3	7
104	25	17	68	3	9
105	18	17	69	3	8.5
106	16	19	60	3	7
107	19	16	64	4	8
108	18	19	54	4	7
109	13	16	52	3	7
110	18	19	89	4	8
111	20	22	109	4	7
112	14	17	57	3	6
113	12	19	67	3	7
114	18	21	77	4	8
115	25	25	92	5	8

Table 3.

Flowering Specimens in the Cheeseman Herbarium, Auckland Museum.

Identity, Locality and No.	Internode length.	Leaf width.	Leaf length.	Pedicel length.	Flower length.
<i>Hebe obtusata</i>					
Muriwai, 7670	10	15.5	35	2	6
Muriwai, 7671	10	14	24	1.5	6
Muriwai, 7672	12	14	22	2	5
Kare Kare, 7673	8	16	31	2	6
<i>Veronica bishopiana</i>					
Huia, 2160	12	14	45	2	5
Huia, 7674	14	13	40	2	5
<i>Hebe salicifolia</i> var. <i>stricta</i>					
Woodhill, 7763.1.	13	15	59	2	6
Woodhill, 7763.2.	22	16	68	2	5.5
New Lynn, 7764	14	12	63	2	5
var. <i>longiracemosa</i>					
Waitakere Falls, 7775	19	20	79	2	6
<i>Hebe macrocarpa</i>					
Anawhata, n.n.	18	22	86	4	8
Nihotupu, 7713.1.	29	21	87	4	8
Nihotupu, 7713.2.	23	23	83	4	8
Nihotupu, 7714	20	24	107	4	8
<i>Hebe</i> x <i>macrosala</i>					
Northcote, 7739 (as <i>H.</i> x <i>affinis</i> )	15	16	67	2	8

Table 4.

Collection of flowering specimens from an exposed clay bank above Duck Creek, Blockhouse Bay, at reference point 235516 on the N.Z. Lands and Survey Titirangi map of 1944 (1 : 25,000 series).

No.	Internode length.	Leaf width.	Leaf length.	Pedicle length.	Flower length.
40	5	7	32	2.5	6
71	7	10	33	3	7
72	4	8	16	3	6.5
73	3	9	23	2	5
74	6	13	38	3	7
75	5	12	38	3	6.5
76	5.5	10	37	3	7
77	9	14	42	3	7
78	6	9	27	3	7
79	5	13	43	3	7
80	9.5	7	27	3	5

Table 5.

Mass collection of fruiting specimens from Huia.

No.	Internode length.	Leaf width.	Leaf length.	Capsule width.	Capsule length.
17	11	10	35	2	3
18	15	13	36	2	2.5
19	11	14	37	2	3
25	17	13	60	2	3
27	15	11	50	2	4.5
28	11	13	43	5	7
30	8	11	35	2	3
32	6	7	21	2	3
34	9	18	58	3.5	5
327	18	19	77	5	6
329	13	14	60	4.5	5.5
331	20	18	85	5	6
341	9	9	42	2	3
344	12	12	43	2	3
346	7	11	45	2	3
347	14	10	41	2	3.5
348	19	19	85	4	6
349	17	17	70	3.5	5.5
359	16	17	69	3	5.5
351	18	24	83	4	7
352	9	17	67	2	3
353	18	23	79	4	7
354	7	11	45	2	3
355	8	13	63	2	3.5
356	8	14	62	2	4
357	9	15	47	2.5	3.5
358	17	19	76	5	8.5
359	8	9	37	2.5	3
360	13	25	62	4	6
361	9	13	60	2	3.5
362	5	15	44	2	3.5
363	10	18	77	4	5
364	12	15	81	2.5	4
365	6	15	44	2	3
366	10	6	32	2	3



Table 6.

Mass collection of fruiting specimens from Duck Creek, Blockhouse Bay.

No.	Internode length.	Leaf width.	Leaf length.	Capsule width.	Capsule length.
143	14	12	49	3	4
145	17	15	68	4	5.5
150	23	17	79	4	6
151	30	21	87	4	6
156	10	12	42	2.5	3
158	13	14	43	2.5	4
159	19	19	64	4	5
160	25	18	88	4	6
163	17	18	51	3.5	5.5
176	19	11	50	2	3
177	18	15	81	3.5	5
181	20	23	90	4.5	6.5
186	15	9	38	2	3
187	18	9	44	2	3
189	14	13	40	3.5	5.5
190	10	10	50	1.5	3
194	13	14	64	3	5
197	17	16	75	3.5	5.5
199	17	19	67	4	6
200	21	17	64	3.5	6
201	19	22	103	2	3
203	17	19	80	4	5.5
205	13	17	54	4	5.5
206	21	15	75	3	6
207	19	18	62	4	6.5
208	21	15	73	3.5	6.5
210	22	18	67	4	6.5
211	14	20	66	4	5.5
214	24	20	82	4	6.5
215	22	15	70	3.5	5
216	30	23	109	5	7
224	20	23	90	3	6
225	30	17	89	4	7
226	15	18	59	4	6
233	22	22	82	3.5	6

Table 7.

Fruiting specimens in the Cheeseman Herbarium, Auckland Museum.

Identity, Locality and No.	Internode length.	Leaf width.	Leaf length.	Capsule width.	Capsule length.
<i>Hebe obtusata</i>					
Muriwai, 7670	10	13	29	2.5	3.5
Muriwai, 7671	11	17	36	2.5	4
Muriwai, 7672	11	16	28	3	5
Kare Kare, 7673	8	16	31	2.5	4
Anawhata, n.n.	7	15	21	2	3
<i>Veronica bishopiana</i>					
Huia, n.n.	9	13	44	2	3
<i>Hebe salicifolia</i> var <i>stricta</i>					
Woodhill, 7763.1	13	15	59	2	3
New Lynn, 7764	14	12	63	2	3

Identity, Locality and No.	Internode length.	Leaf width.	Leaf length.	Capsule width.	Capsule length.
<i>var. longiracemosa</i> Waitakere Falls, 7775	19	20	79	2	3.5
<i>Hebe macrocarpa</i> Nihotupu, 7713.2	23	23	83	4	6
<i>H. x macrosala</i> Northcote, 7730 (as <i>H. x affinis</i> )	15	16	67	3.5	6

Table 8.

Collection of fruiting specimens from an exposed clay bank above Duck Creek.

No.	Internode length.	Leaf width.	Leaf length.	Capsule width.	Capsule length.
72	4	8	16	3.5	5
74	6	13	38	3.5	6
75	5	12	38	3	5
76	5.5	10	37	3.5	5
77	9	14	42	4	6
79	5	13	43	3.5	5
80	9.5	7	27	3	4.5

## Notes—

1. All measurements are in mm.
2. "Internode length" refers to the second internode beneath the lowermost pair of racemes on a mature woody branchlet.
3. "Leaf width" and "leaf length" were measured on one of the pair of leaves subtending the lowermost racemes.
4. "Pedicel length" refers to the pedicel of a fully-open flower near the base of one of the racemes.
5. "Flower length" is the length of the calyx and corolla of the fully-open flower.
6. "Capsule width" and "length" refer to a mature capsule near the base of a raceme.

## REFERENCES.

- ANDERSON, E., 1949. Introgressive hybridization. Wiley, New York, 109 pp.
- ANDERSON, E., 1939. Recombination in species crosses. *Genetics* 24: 668-698.
- ARBER, AGNES, 1954. The mind and the eye. A study of the biologist's standpoint. Cambridge Univ. Press, 146 pp.
- CHEESEMAN, T. F., 1925. Manual of the New Zealand flora. ed. 2, 1163 pp.
- CLAUSEN, J., 1951. Stages in the evolution of plant species. Cornell Univ. Press, 206 pp.
- COCKAYNE, L., 1929. New combinations in the genus *Hebe*. *Trans. N.Z. Inst.* 60: 465-472.
- COCKAYNE, L., and H. H. ALLAN, 1926. The present taxonomic status of the New Zealand species of *Hebe*. *Trans. N.Z. Inst.* 57: 11-47.
- COOPER, R. C., 1954. Pohutukawa x Rata. Variation in *Metrosideros* (Myrtaceae) on Rangitoto Island, New Zealand. *Rec. Auckland Mus.* 4 (4): 205-211.
- COOPER, R. C., 1953. The Australian and New Zealand species of *Pittosporum*. Ph.D. thesis (unpub.), Auckland Mus. library.
- PETRIE, D., 1926. Descriptions of new native plants. *Trans. N.Z. Inst.* 56: 6-16.
- ROBSON, G. C., 1928. The species problem. Oliver and Boyd, London, 283 pp.

Diagrams of Measurements in Tables 1-4 to show Variation in flowering specimens of *Hebe*.

Fig. 1. 35 specimens from Huia, collected July-August, 1954.

Fig. 2. 35 specimens from Blockhouse Bay, collected July-August, 1954.

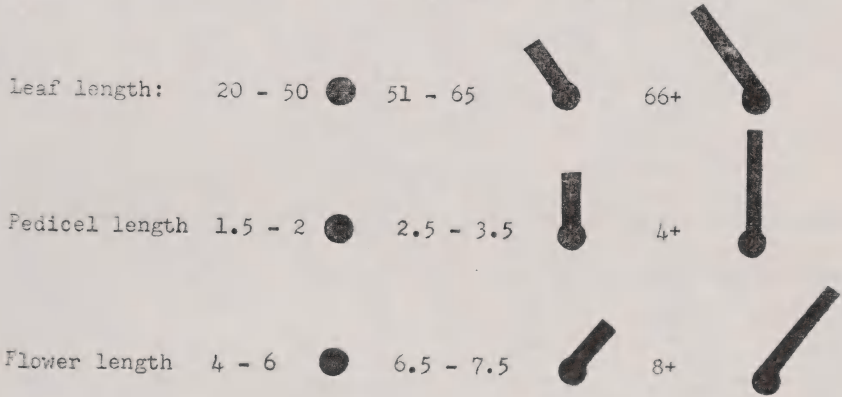
Fig. 3. 15 specimens in the Cheeseman Herbarium. The numbers alongside the symbols refer to the species and hybrids:

1. *Hebe obtusata*.
2. *H. salicifolia* var. *stricta*.
3. *H. salicifolia* var. *longiracemosa*.
4. *H. macrocarpa*.
5. *H. x macrosala*.
7. *Veronica x bishopiana*.

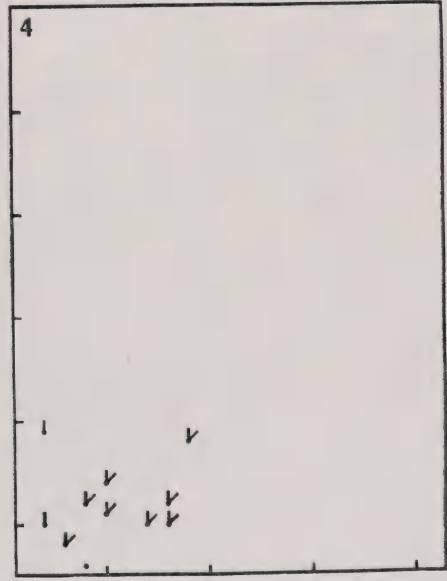
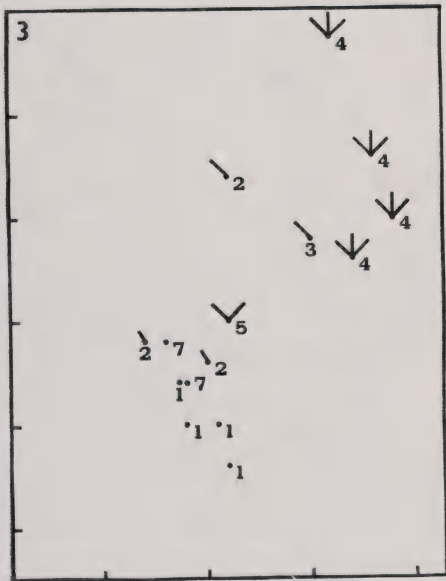
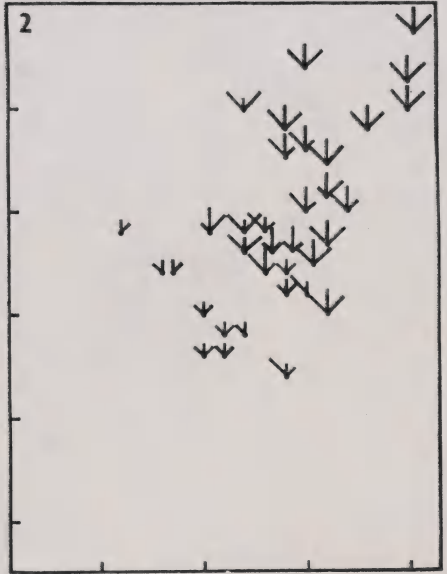
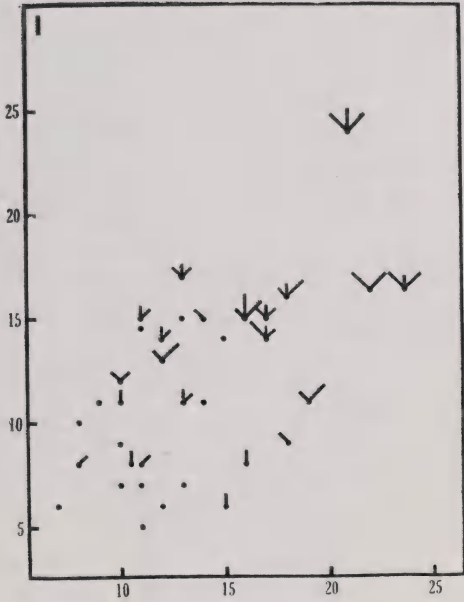
Fig. 4. 11 dwarfed specimens from a clay bank above Duck Creek, Blockhouse Bay, collected August, 1954.

Horizontal axis, leaf width; vertical axis, internode length.

Three other characters diagrammed by rays:



All measurements are in mm.



Diagrams of Measurements in Tables 5-8 to show Variation in fruiting specimens of *Hebe*.

Fig. 5. 35 specimens from Huia collected July-November, 1954.

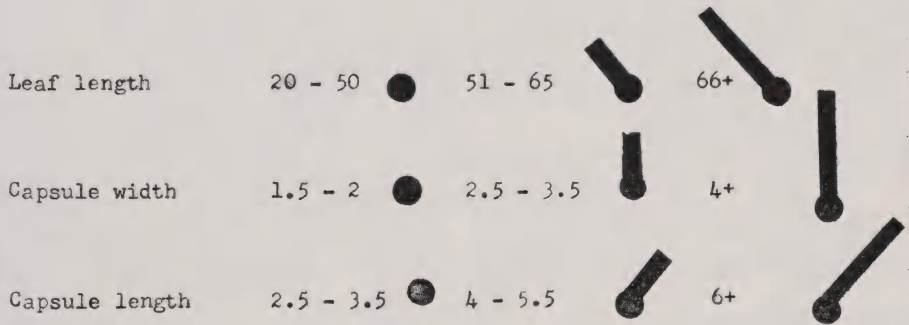
Fig. 6. 35 specimens from Blockhouse Bay collected September-October, 1954.

Fig. 7. 11 specimens in the Cheeseman Herbarium. The numbers alongside the symbols refer to the species and hybrids:

1. *Hebe obtusata*.
2. *H. salicifolia* var. *stricta*.
3. *H. salicifolia* var. *longiracemosa*.
4. *H. macrocarpa*.
5. *H. x macrosala*.
7. *Veronica x bishopiana*.

Fig. 8. 7 dwarfed specimens from a clay bank above Duck Creek, Blockhouse Bay, collected August, 1954.

Horizontal axis, leaf width; vertical axis, internode length.



All measurements are in mm.

